THE RAINFALL CAPACITY OF THE "EQUATORIAL CURRENT," A PERIODIC FACTOR IN CLIMATE

By LOUIS BESSON

[Translation by B. M. Varney]

In studying the observations made during a half century at the Observatory of Montsouris one is brought to a result of which the significance extends probably far outside the immediate environs of Paris.

The examination of the amounts of rainfall has already shown [13] that a change occurred about 1900 in the raininess of the seven months November to May, a period which has become, on the average, since then rainier than before, the difference amounting to 27 per cent of the general 50-year average.

The source of our rain being the warm and moist air current which comes to us from between south and west, and which has been known since Dové's time as the *equatorial current*, it is natural to suppose that the frequency of this current for the seven months noted should have shown a variation parallel with that of the rainfall amounts.

Now such is not the case. It has varied in a thoroughly irregular manner, whereas from June to October, a season in which the amount of rainfall does not show a change of régime, the frequency of the *equatorial current* was notably greater before 1900 than after.

This inconsistency disappears if we take the ratio of the rainfall amount to the number of tri-hourly observations of the *equatorial current*.[14] The result is quite unexpected.

In the course of 50 years this ratio has brought out remarkably similar fluctuations in the two seasons under consideration, as shown by Figures 1 and 2.

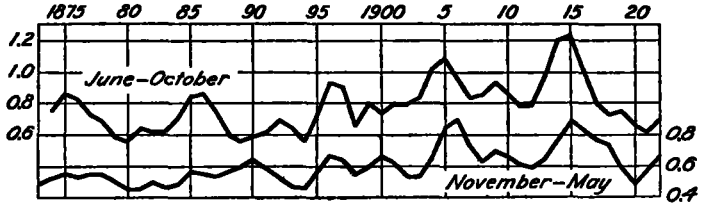

FIG. 1.—The sum of the successive accumulated deviations from the mean ratio between the amount of rainfall and the number of tri-hourly observations of the "equatorial current"

In the first figure, in order to make the general trend of the variations stand out, there is shown the sum of the successive accumulated deviations. Thus, if r_1, r_2, r_3 . . . represent the values of the ratios for the successive years, m their arithmetical mean, and $e_1 = r_2 - m$, $e_2 = r_2 - m$, $e_3 = r_3 - m$ . . . the deviations, then the sums of the accumulated deviations are successively e_1, $e_1 + e_2$, $e_1 + e_2 + e_3$ . . . . The sum is lowered if the deviations have a sustained tendency to be negative and is raised if they have a sustained tendency to be positive. When, as in the figure, each summer is plotted in relation to the immediately succeeding winter, the correlation between the two lines is at a maximum, reaching the value 0.96.

In general the ratio has varied from season to season with the amount of the October-March rainfall, having plainly oscillated about a lower value before 1900 than after that year. From what has just been said about the condition of maximum correlation it follows further that the modifications of the ratio begin to make themselves felt in summer before they do in winter.

In Figure 2 are set forth the same ratio values after smoothing by the usual process of doubling each value, adding to it the preceding and the following values and dividing the sum by 4. As in Figure 1, the parallelism between the two seasonal variations is almost perfect. There is to be noted, also, in the unsmoothed values of the ratio (not reproduced here for lack of space) a periodicity of 10 years length which is very clear.

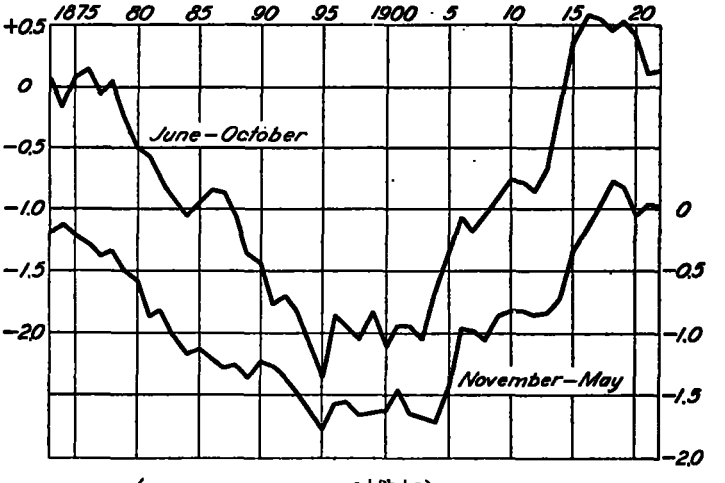

FIG. 2.—Ratios $\left(\text{smoothed by the formula } \frac{a+2b+c}{4}\right)$ between the amount of rainfall and the number of tri-hourly observations of the "equatorial current"

The curve for the summer values shows, moreover, between the principal maxima secondary sinuosities, which seem to show the existence of another period, of about 5 years, which is also fairly clear in winter.

The phrase *rainfall capacity of the equatorial current* seems fairly well to describe this ratio, in which we encounter for the first time a climatic factor which varies in both seasons in the same manner from one year to another, and which shows a periodicity about which there can be no doubt.

[13] See Annales des Services techniques d'Hygiène de la Ville de Paris, 5, 1923, p. 194.

[14] At Montsouris it is customary to class under this designation the directions S., SSW., SW., and half of the directions SSE. and WSW.